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to do so, and alternative investment opportunities become less attractive, the question of building a railway might well be reviewed.

The mission would be more favorably disposed to a railway if there were no alternative means of reducing the present high transport rates between the Jezireh and Aleppo and Latakia. However, the building of good, all-weather roads, supplemented by the construction of grain storage facilities in the Jezireh, should make it possible to lower transport charges significantly by reducing truck maintenance and depreciation costs and somewhat diminishing seasonal transport peaks. The mission recommends, therefore, that the government undertake this task as a matter of high priority.

To this end the following program should be carried out within the next five or six years:

1. *Improvement and partial realignment of the Aleppo-Latakia road.* The improvement and widening of this road is imperative, and since topographic conditions make widening of certain sections impossible, an entirely new road must be built in part. A new road, for example, will be necessary for a distance of some 30 kilometers west of Jisr ech Chog-hour. Improvement of the section south of Idlib and crossing the Djebel Zâouiye would also be extremely difficult. The mission recommends strongly that this stretch be replaced by a north-south road running through the Roudj. Such a road would not only avoid most of the mountainous terrain but would simultaneously serve the new agricultural district of the Roudj. The cost of the entire project, including the new road construction, is tentatively estimated at £S 7.37 million.

2. *Improvement and widening of the Aleppo-Raqqa road.* This road, 190 kilometers long and part of the trunk highway to the Jezireh, has an asphalt surface only four to five meters wide. In line with recent proposals made by the Syrian government, the mission suggests its widening to six meters, with a two-meter berth on each side. The government has estimated the cost at £S 3.38 million.

3. *Construction of a new road connecting Raqqa with Kamichliye, via Kantari, Tell Tamer and Tloul Mohammed, and continuing from Kamichliye, via Demir Kapu and Deirik, to Ain Divar on the Syrian-Turkish frontier* (total length: 362 km). Unlike earlier proposals, the road we recommend would not follow the present truck route between Raqqa and Km. 47 on the Hassetche-Deir ez Zor road, but would run north of the Djebel Aabd el Aaziz. In this way it would tap a much larger agricultural

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region, including the dry-farming area south of Ras el Ain and the irrigated area in the Khabour river valley. It would be advisable to start the construction of the Kamichliye-Ain Divar section first, because this rich agricultural region of heavy rainfall is now the most inaccessible part of the Jezireh. To feed the trunk highway the mission also recommends the construction of the following roads: (1) Ras el Ain-Hassetche, crossing the main highway at or near Tell Tamer (73 km); (2) Hassetche-Tloul Mohammed (60 km), thus linking the provincial capital with Kamichliye, the region's commercial center; (3) Derbassiye-main road (30 km); (4) Demir Kapu-Tell Kotchek (30 km); and (5) much farther to the west, Tell Abiad-Kantari (46 km). The first two are considered the more important. In general this proposed road network conforms to the most recently expressed views of the Syrian government, which has tentatively estimated the cost, pending engineering surveys, at about £S 46 million.

North-South Communications

We turn now to a consideration of the other principal transport routes. With respect to the north-south transport axis, improvement of communications between Aleppo and Damascus is most important. A direct standard-gauge railway link between these cities has often been proposed, either by the laying of an additional rail on the narrow-gauge line from Damascus to the junction with the standard-gauge line at Rayak in Lebanon or by the building of a new railway from Damascus to Homs, where it would connect with the DHP line to Aleppo. The mission is convinced, however, that the volume of bulk goods suitable for rail transport moving between Aleppo and Damascus is far too small to justify the large investment required, at least £S 18 million for the former and £S 36 million for the latter project. The solution is rather to improve and widen the Aleppo-Damascus road. The section between Hama and Aleppo urgently demands improvement, and the entire road should be widened by at least one meter to permit easier flow of two-way vehicular traffic. The cost of widening would probably be about £S 10,000 per kilometer or a total of about £S 4 million.

The transport route south from Damascus to Dera'a and the Jordanian frontier is served both by road and the Hedjaz Railway. The problems of the latter have already been discussed. The road, although not as well

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travelled as the one to Aleppo, is still important for the transport of Syrian agricultural products and petroleum products destined for Jordan. The very bad section between Cheikh Meskine and Dera'a requires early attention, and the entire road should be widened by one meter after the completion of the Damascus-Aleppo road project. The mission estimates the total cost involved at £S 1.3 million.

Other Road Projects

Together with the Latakia-Aleppo-Jezireh road, the route between Damascus and Beirut is the most important to the Syrian economy. In fact the traffic on the Beirut-Damascus road is denser and steadier than that on the Latakia-Aleppo road. An urgent program to improve the surface of this road should be undertaken by the two countries concerned. For the improvement of the 35-kilometer section in Syrian territory, the mission anticipates that £S 1.05 million will need to be spent. It can be expected, however, that before many years more thorough-going measures will be necessary to accommodate the constantly growing traffic. To meet this longer-term need, proposals have been made to build a new road paralleling the old one and to construct a long tunnel at Hamana to bypass the most dangerous section across the Lebanon range, where traffic is often held up by fog and snow. The total cost has been estimated at £S 29 million, presumably to be shared by Syria and Lebanon. Parallel highways would certainly permit a great increase in traffic and would considerably reduce the prevailing high accident rate, by making possible the accommodation of slow-moving truck traffic and high-speed vehicular traffic on separate roads. Since the problem is not immediately urgent and the best solution remains to be worked out in detail, the mission considers it unnecessary to make specific proposals. It suggests, instead, that over the next five years the two governments jointly finance an engineering survey of the problem in order to prepare definite plans; an expenditure of £S 100,000 by each government should suffice.

The third most important transversal connection with the Mediterranean is that between Homs and Tripoli, served both by the DHP railway and by road. The road is of some importance, but several sections are in bad condition, particularly the 10-15 kilometer section just west of Homs and a shorter section passing through Lebanon before coming to Tell Kalakh. Improvement of this road, however, can probably be handled

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within the framework of the maintenance program proposed below. It is important that the Syrian and Lebanese governments come to an agreement on better maintenance of the section before Tell Kalakh.

Aside from the trunk highways discussed above, the mission has considered certain special road projects, including two which would provide better links between Homs and Hama on the one hand and the Syrian coast and Latakia on the other. Fundamental improvement of the road from Hama to Banias whence a road runs north to Latakia has sometimes been proposed. The mission believes a more economical solution would be to build a link between Hama and the main north-south road running through the Ghab for which provision has already been made in the Ghab project. The Ghab road would in turn connect with the Aleppo-Latakia highway. We have accordingly included £S 1.5 million for the building of this link in the program recommended for the next five or six years. Homs is now linked with the Syrian coast by a poor and rather circuitous road which branches off from the Homs-Tripoli highway at Tell Kalakh and passes through difficult terrain. It has been proposed, instead, to construct a shortcut between Akkari and Hamidiye which would connect with the coastal highway to Latakia and would cost about £S 1.8 million. In the mission's opinion, however, construction of this road is not very urgent, particularly since the Homs area is fairly well served by the port of Tripoli. The mission suggests, therefore, that it be built only toward the end of the program if funds are available.

Elsewhere the mission has pointed to the potential importance of the tourist trade. In order to stimulate this trade some of Syria's principal historical monuments such as the Krak des Chevaliers, the ruins of Saint Simeon, etc., should be made more accessible by road. The mission accordingly suggests that £S 1.5 million be allocated to construct such roads.

Road Maintenance[20]

The construction of new roads will be of little avail if they are allowed to deteriorate quickly. By and large maintenance has been poor in the past, although apparently not because of inadequate appropriations. Over the five-year period 1949-1953 an average of £S 3.3 million annually was allocated for maintenance; in 1954 £S 5.8 million was so allocated. The

[20] See Annex H, p. 439.

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of the traffic load on various routes at certain times of the year. As an aid to sound future development, it will be to the advantage of the Syrian government to place the collection of traffic statistics on an organized scientific basis as soon as possible.

B ROAD CONSTRUCTION

Most of the main surfaced roads in western Syria are of 5.5-meter width; in the east the five-meter type is more common. Neither is sufficient for safety under present or anticipated traffic conditions. More satisfactory specifications for general use would call for not less than six meters of finished surface and a firm shoulder of 1-1.5 meters on each side. The mission strongly recommends that hereafter this basic design be used for all new construction, repair or reconstruction of major roads.

A number of road surface materials and methods have been used or considered. The most common construction is of waterbound macadam, both with and without an asphalt covering.

Except for such purposes as the construction of "Irish bridges",[5] concrete is seldom used as a road surface in Syria, cement being considered too expensive. The local delivered price was said to be £S 90 per ton in 1953, although the mission was informed that in 1954 cement could be obtained for £S 80 per ton.

The cement industry is protected by the government and enjoys substantial profit margins. Moreover, the prices quoted include excise taxes of £S 15 per ton, from which public bodies might reasonably be exempt. But the basis of present prices Syria can hardly afford to make greater use of this superior roadbuilding material in meeting the specifications required for the growing commercial trucking.

Recently the possibility of constructing low-cost mix-in-place bituminous roads, with or without soil stabilization, has attracted much attention. The method has been used successfully in several countries of the Middle East, but to date it has not been tried in Syria, partly because the local asphalts of Kfarie and Djebel Bichri have not proven adaptable to the process but also because of some doubt that roads so constructed can withstand heavy truck traffic.

[5] Actually not a bridge but a type of ford, useful where traffic density is moderate and the small or infrequent water flow does not justify a real bridge. The road dips down to streambed level and is strongly paved with reinforced concrete, providing a firm crossing even when inundated.

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This is one of the best-known types of "low cost" roads.[8] The success of the method depends largely upon the climate and the soil characteristics. A firm, sandy soil which does not require stabilization is best, for when a soil-stabilizing treatment must be applied the construction cost is no longer low. Costs are also affected by the necessity of hauling sand or stone long distances. Syrian conditions in general are less favorable to the method than might be expected, and in the extreme northeast are definitely unsuitable.

The mission has studied carefully the question of using low-cost road-building methods in certain parts of Syria. Apart from the factors mentioned, on the main routes it is evident that the traffic wear is too great even for the stone-based macadam with 15 cm. of block, 12 cm. of gravel and three cm. of asphalt pre-mix topping. It must be noted also that in popular usage "low-cost roads" mean low in construction cost only, not necessarily in expense of maintenance. The costs of material, labor, haulage, etc., add to the costs of maintenance as well as road-building. Where provision of adequate maintenance is difficult, it is often better to invest in a better road initially.

Mix-in-place or similar methods may hold promise in raising the standards of the desert roads or *pistes* (tracks). The mission did not find these in as bad a condition as so often reported; it appears that many instances of mired vehicles result from careless driving rather than from unavoidable road hazards. Nevertheless, some improvement of these routes must eventually be considered. At the moment it might best be confined to proper signposting, construction of Irish bridges, and repairs in the very worst places. In view of the limitation on development funds, road-building efforts just now should be focused mainly upon the several projects of greater urgency than these.

C ROAD MAINTENANCE

Close to the capital city, the roads appear to be rather well maintained; elsewhere the difference is at once noticeable. Toward the east many of the

[8] See: Landbouwwegen, Reports of a Congress of the Royal (Netherlands) Institute of Engineers, 1953; D. W. Lister, Bituminous Soil Stabilization for Road Foundations (Cairo), 1953; Low Cost Roads and Runways (Cairo), The Shell Company, 1947; Bituminous Products for Roads and Runways (supplement), The Shell Company, 1950; Stabilisation des Sols, Bulletin Intérieur Shell; Wet Sand Mix, Een voordelig procede voor de verharding van wegdekken enz. (Shell); etc.